

AMENDMENT UNDER 37 C.F.R. § 1.116
APPLICATION NO. 09/437,246
ATTORNEY DOCKET NO. Q56708

IN THE CLAIMS:

Claims 4, 8, 9, 26, 28, 33, 35, 45, 48, 49, and 52 are canceled.

This set of claims is a clean set of pending claims 1, 5-7, 10-25, 27, 29-32, 34, 36-44, 46, 47, 50, 51, and 53-61, consolidating any previous versions of pending claims into this single clean version, with changes made in this response being shown in the Appendix.

1. (Amended two times) An ink cartridge for a printing apparatus providing ink to a print head through a tapered ink supply needle and removably attached to the print head, comprising:

- an ink chamber for containing ink;
- an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;
- a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith;
- a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, wherein said valve device does not comprise a sphere; and
- a sealing film sealing said external opening of said ink supply port until said ink supply needle penetrates into said ink supply port.

5. (Three Times Amended) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

- an ink chamber for containing ink;
- an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

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a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith, said packing member comprising a hole and a protruding rim surrounding said hole; and

a valve device contained in said ink supply port, closing said ink channel by elastically abutting against said protruding rim of said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle;

wherein said abutting of said valve device against only an upper part of said protruding rim performs said closing of said ink channel.

6. An ink cartridge as set forth in claim 5, wherein said packing member comprises a first surface facing said ink chamber formed with a cylindrical recess having a diameter acceptable to receive a part of said valve device at said first surface.

7. An ink cartridge as set forth in claim 6, wherein said hole of said packing member having a diameter smaller than said diameter of said cylindrical recess at said first surface.

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~~10. (Amended three times) An ink cartridge as set forth in any one of claims 1 or 5, wherein said valve device comprises:~~

~~a valve member selectively contacting with a surface of said packing member, said valve member being forced by the ink supply needle of the printing apparatus when the ink cartridge is mounted on the printing apparatus; and~~

~~an elastic member always urging said valve member toward said packing member.~~

11. An ink cartridge as set forth in claim 10, wherein said valve member comprises a support structure for supporting said elastic member.

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12. An ink cartridge as set forth in claim 11, wherein said support structure is radially shaped.

13. An ink cartridge as set forth in claim 10, wherein said valve member comprises a flange for supporting said elastic member.

14. An ink cartridge as set forth in claim 1, wherein said packing member comprises a second surface facing said external opening with the tapered portion tapered from said external opening toward said ink chamber at said second surface, for guiding the ink supply needle of the printing apparatus.

15. An ink cartridge as set forth in claim 14, wherein said taper portion fits with the ink supply needle.

16. An ink cartridge as set forth in claim 1, wherein said packing member comprises a second surface facing said external opening with a fitting portion to fit with the ink supply needle of the printing apparatus.

17. An ink cartridge as set forth in claim 1, wherein said packing member is made of an elastic material and provided with a lubricant coat at least at an area with which the ink supply needle contacts.

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18. (Amended) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:
an ink chamber for containing ink;

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a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:

- a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and
- a guide body for guiding said valve body to slide substantially vertically with respect to said packing member, and operably suppressing a horizontal deviation of said valve device;

wherein said valve body comprises:

- a sealing portion for closing said ink channel of said packing member when said valve device contacts with said packing member; and
- an ink channel allowing ink to pass therethrough when said valve body is urged to come out of contact with said packing member by the ink supply needle of the printing apparatus.

19. An ink cartridge as set forth in claim 18, wherein a part of said ink channel of said valve body is formed by cutting off said sealing portion.

20. An ink cartridge as set forth in claim 18, wherein said sealing portion of said valve body comprises a substantially flat surface with which the ink supply needle contacts.

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21. (Amended) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

- an ink chamber for containing ink;
 - an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;
 - a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and
 - a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:
 - a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and
 - a guide body for guiding said valve body to slide substantially vertically with respect to said packing member;
- wherein said guide body comprises:
- an axial portion being connected to said valve body; and
 - a guide block formed at an end of said axial portion opposite to said valve body, said guide block guiding said valve body to slide substantially vertically with respect to said packing member.

22. An ink cartridge as set forth in claim 21, wherein said axial portion of said guide body is formed as one unit with said valve body.

23. An ink cartridge as set forth in claim 21, further comprising a guide unit provided in said ink supply port to receive said guide block of said guide body.

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24. (Amended) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

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a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:

a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and

a guide body for guiding said valve body to slide substantially vertically with respect to said packing member, and operably suppressing a horizontal deviation of said valve device;

wherein said valve body and said guide body are separately formed and fixed to each other by fixing means.

25. (Amended) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

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a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:

a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and

a guide body for guiding said valve body to slide substantially vertically with respect to said packing member, and operably suppressing a horizontal deviation of said valve device;

wherein said valve body and said guide body are formed as one unit with each other.

27. (Amended two times) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:

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a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus, and
a guide body for guiding said valve body to slide substantially vertically with respect to said packing member;
wherein said guide body comprises:
an axial portion being connected to said valve body, and
a guide block formed at an end of said axial portion opposite to said valve body, said guide block guiding said valve body to slide substantially vertically with respect to said packing member; and
wherein said guide body formed with a groove extending from said guide block through said axial portion.

29. (Amended two times) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:
an ink chamber for containing ink;
an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;
a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and
a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:
a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus, and

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a guide body for guiding said valve body to slide substantially vertically with respect to said packing member;
wherein said valve body of said valve device comprises a surface facing said packing member, and a member protruding from said surface and contacting with a tip end of the ink supply needle.

30. (Amended) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;
an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;
a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and
a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:
a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus, and
a guide body for guiding said valve body to slide substantially vertically with respect to said packing member;
wherein said valve body of said valve device comprises a surface, facing said packing member, provided with a notch.

31. An ink cartridge as set forth in claim 30, wherein said notch of said valve body has a tapered angle which is the same as that of the tapered ink supply needle.

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32. (Amended) An ink cartridge as set forth in claim 30, wherein said notch of said valve body has a tapered angle which is smaller than that of the tapered ink supply needle.

Sub. 1 Cont. 34. (Amended) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

SA a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising a valve body contacting with said packing member and comprising a substantially flat surface with which the ink supply needle contacts;

wherein:

said valve body of said valve device comprises a surface formed with a spherical surface contacting with said packing member; and

said spherical surface of said valve device has a diameter of curvature larger than a diameter of the widest part of said valve body.

Sub. 1 Cont. 35 Cont. 36. (Amended two times) An ink cartridge as set forth in claim 11, wherein said valve body of said valve device comprises a surface formed with a spherical surface contacting with said packing member, and wherein said spherical surface of said valve device is formed with a flat portion with which the ink supply needle contacts.

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37. (Amended three times) An ink cartridge as set forth in any one of claims 1 or 5, wherein said valve device comprises:

a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and
an elastic support portion for supporting said valve body.

38. (Amended three times) An ink cartridge as set forth in any one of claims 1 or 5, further comprising a packing retainer for retaining said packing member at said external opening of said ink supply port.

39. An ink cartridge as set forth in claim 38, wherein said packing retainer comprises a film capable of being penetrated by the ink supply needle of the printing apparatus.

40. An ink cartridge as set forth in claim 39, wherein said film is formed with a hole which enables the ink supply needle to easily pass through.

41. An ink cartridge as set forth in claim 40, wherein said hole is formed by cutting said film in a cross shape.

42. An ink cartridge as set forth in claim 38, wherein said packing retainer has a protruding portion protruding from said external opening toward the center thereof.

43. An ink cartridge as set forth in claim 16, wherein said fitting portion comprises a first fitting position for fitting the ink supply needle of the printing apparatus when the ink supply

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needle is inserted from said external opening, and a second fitting position for fitting the ink supply needle on the ink supply needle is further inserted toward said ink chamber.

44. An ink cartridge as set forth in claim 43, wherein said first fitting position is initially sealed prior to use.

46. (Amended two times) A printing apparatus for ejecting ink on a printing medium, comprising:

- a print head;

- a tapered ink supply needle; and

- an ink cartridge capable of communicating with said print head through said tapered ink supply needle and removably attached to said print head,

- said ink cartridge comprising:

 - an ink chamber for containing ink;

 - an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising and external opening;

 - a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

 - a non-spherical valve device contained in said ink supply port, closing said ink channel by elastically abutting said protruding rim of said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle;

- wherein said abutting of said valve device against only an upper part of said protruding rim performs said closing of said ink channel.

47. A printing apparatus as set forth in claim 46, wherein said valve device comprises:

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a valve member selectively contacting with a surface of said packing member, said valve member being forced by said ink supply needle of the printing apparatus when said ink cartridge is mounted on the printing apparatus; and
an elastic member always urging said valve member toward said packing member.

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50. (Amended two times) A printing apparatus as set forth in any one of claims 1 or 5, wherein said ink supply port includes a concave portion, and wherein said packing member includes a protruding portion extending toward said supply port and fitting with the concave portion of said ink supply port.

51. (Amended) An ink cartridge for a printing apparatus providing ink to a print head through a tapered ink supply needle, said ink cartridge capable of providing ink to the print head through the ink supply needle, the ink cartridge comprising:

- an ink chamber containing ink therein and an absorbent material;
 - an ink channel for providing ink from said ink chamber to the print head of the printing apparatus;
 - a first member provided at said ink channel, forming a part of said ink channel for allowing a flow of ink, said first member sealing the ink supply needle of the ink printing apparatus by fitting therewith; and
 - a second member contained in said ink channel elastically abutting against said first member in a direction which is the same as a direction of the sealing by said first member with said second member, said second member selectively opening and closing said ink channel in conjunction with the ink supply needle;
- wherein a direction of said ink channel, from the ink port to the ink chamber having the absorbent material, is substantially the same direction of the sealing by said first member with said second member.

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53. An ink cartridge for a printing apparatus providing ink to a print head through a tapered ink supply needle and removably attached to the print head, comprising:

- an ink chamber for containing ink;
- an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;
- a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and
- a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle;

wherein said ink supply port includes a concave portion, and wherein said packing member includes a protruding portion extending toward said supply port and fitting with the concave portion of said ink supply port.

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54. (Amended) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

- an ink chamber for containing ink;
 - an ink supply port for supplying from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;
 - a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and
 - a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device being urged by the ink supply needle of the
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printing apparatus to open said ink channel, at substantially the same time, when the ink supply needle is sealed by said packing member;

wherein:

a distance from a part of said valve device which first contacts the ink supply needle when the needle inserts into said ink supply port to a part of said packing member which engages with the ink supply needle is longer than a distance between a tip end of the ink supply needle and a part of the ink supply needle which first contacts the packing member when the ink cartridge is coupled to the printing apparatus, and said packing member has a surface slanting at a certain angle substantially the same as a tapered angle of the ink supply needle, said slanting surface of said packing member being disposed in the vicinity of where said packing member contacts said valve device.

Claims 55-61 are added as new claims.

55. (New) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

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- an ink chamber for containing ink;
 - a porous member accommodated in said ink chamber for absorbing ink;
 - an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;
 - a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith;
 - a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle; and

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a packing retainer for retaining said packing member at said external opening of said ink supply port;

wherein:

said valve device does not comprise a sphere, and

said packing retainer has a protruding portion protruding from said external opening toward the center thereof.

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56. (New) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith;

a packing retainer for retaining said packing member at said external opening of said ink supply port; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising a valve body contacting with said packing member and comprising a substantially flat surface with which the ink supply needle contacts;

wherein said packing retainer has a protruding portion protruding from said external opening toward the center thereof.

57. (New) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

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an ink chamber for containing ink;
an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;
a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith;
a packing retainer for retaining said packing member at said external opening of said ink supply port; and
a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:
a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and
a guide body for guiding said valve body to slide substantially vertically with respect to said packing member, and operably suppressing a horizontal deviation of said valve device;
wherein said packing retainer has a protruding portion protruding from said external opening toward the center thereof.

58. (New) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:
an ink chamber for containing ink;
a porous member accommodated in said ink chamber for absorbing ink;
an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

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a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle;

wherein:

said valve device does not comprise a sphere, and

said ink supply port includes a concave portion, and wherein said packing member includes a protruding portion extending toward said supply port and fitting with the concave portion of said ink supply port.

59. (New) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising a valve body contacting with said packing member and comprising a substantially flat surface with which the ink supply needle contacts;

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Sub. Int. wherein said ink supply port includes a concave portion, and wherein said packing member includes a protruding portion extending toward said supply port and fitting with the concave portion of said ink supply port.

60. (New) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

an ink chamber for containing ink;

an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;

a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and

a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:

a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus, and

a guide body for guiding said valve body to slide substantially vertically with respect to said packing member, and operably suppressing a horizontal deviation of said valve device;

wherein said ink supply port includes a concave portion, and wherein said packing member includes a protruding portion extending toward said supply port and fitting with the concave portion of said ink supply port.

61. (New) An ink cartridge for a printing apparatus providing ink to a print head through an ink supply needle and removably attached to the print head, comprising:

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an ink chamber for containing ink;
an ink supply port for supplying ink from said ink chamber to the print head of the printing apparatus, said ink supply port comprising an external opening;
a packing member provided in said ink supply port, forming an ink channel for allowing a flow of ink, said packing member sealing the ink supply needle of the printing apparatus by fitting therewith; and
a valve device contained in said ink supply port elastically abutting against said packing member, said valve device selectively opening and closing said ink channel in conjunction with the ink supply needle, said valve device comprising:
a valve body contacting with said packing member and urged by the ink supply needle of the printing apparatus to open said ink channel when the ink cartridge is mounted on the printing apparatus; and
a guide body for guiding said valve body to slide substantially vertically with respect to said packing member, and operably suppressing a horizontal deviation of said valve device;

wherein:

said valve body of said valve device comprises a surface formed with a spherical surface contacting with said packing member, and
said spherical surface of said valve device has a diameter of curvature larger than a diameter of the widest part of said valve body.

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